Space Weather Technical Forecast

Issued on Tuesday, 02 August 2022 at 12:20 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

Space Weather Forecast Headline: No significant activity.

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Solar activity has been very low over the past 24 hours. There are currently two sunspot regions on the visible disc. AR3068 Esi/Beta-gamma in the south centre disc has shown minor growth with several intermediate spots developing near its leader but remains relatively small with respect to its area. The other region is a small unipolar spot that has rotated onto the southeast disc, however more detail may become apparent as it transits the solar disc into a clearer view. No Earth-directed CMEs were observed.

Solar Wind / Geomagnetic Activity: Earth has likely been grazing the fast wind from coronal hole 07, with solar wind speeds, as measured at L1, fluctuating between 430 and 520 km/s. Density was around average, but rose above average at around 02/0500 UTC. The total interplanetary magnetic field (IMF), Bt was generally weak to moderate, at below 9 nT. The north-south component, Bz, fluctuated weakly between +6/-7 nT. The Phi angle was negative (towards the Sun). Geomagnetic activity was Quiet to Unsettled (Kp 1-3)

Energetic Particles / Solar Radiation: The high energy proton flux (10 MeV), as measured by GOES-16 was at background levels. The high energy electron flux (greater than 2 MeV) was at background. Electron fluence showed an erratic but trend, but remained well below the Active threshold (1e8 integrated flux), with an observed fluence value of 3.53e6 integrated pfu recorded at 02/0000 UTC.

Four-Day Space Weather Forecast Summary

Solar Activity: Low to Very Low solar activity is expected to continue, with a slight chance of M-class flares. Flare risks possibly increasing due to active regions rotating onto the visible disc later in the period.

Solar Wind / Geomagnetic Activity: No CMEs have been assessed as Earth-directed. Solar winds are slightly-elevated due to Earth being in the fast wind of CH07/-. These winds are expected to persist until day 3 (4th) with background speeds following as Earth exits into the slow wind. Geomagnetic activity should remain mainly Quiet with a chance of Unsettled or Active intervals through the period.

Energetic Particles / Solar Radiation: The high energy proton flux (greater than 10 MeV) is expected to remain at background levels. The high energy electron flux (greater than 2 MeV) is expected to remain mostly at background to moderate levels, but with a chance of rising to give high levels at the diurnal maxima. The corresponding 24 hour fluence is most expected to remain below the Active threshold (1e8 integrated pfu) but on a steadily increasing trend.

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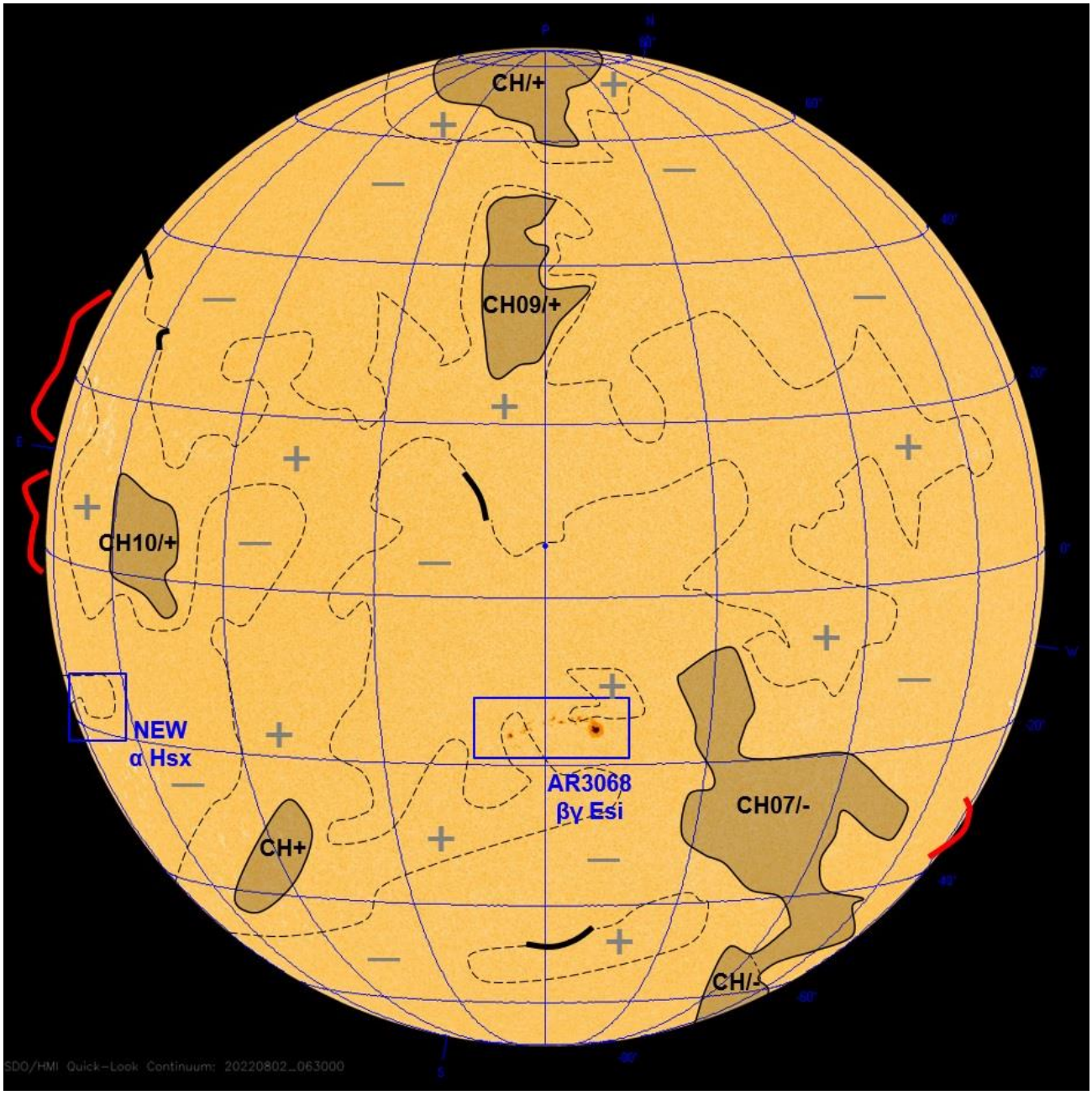
Figure 1. Solar Analysis Valid 02/0800 UTC.



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Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

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Geomagnetic Storms:

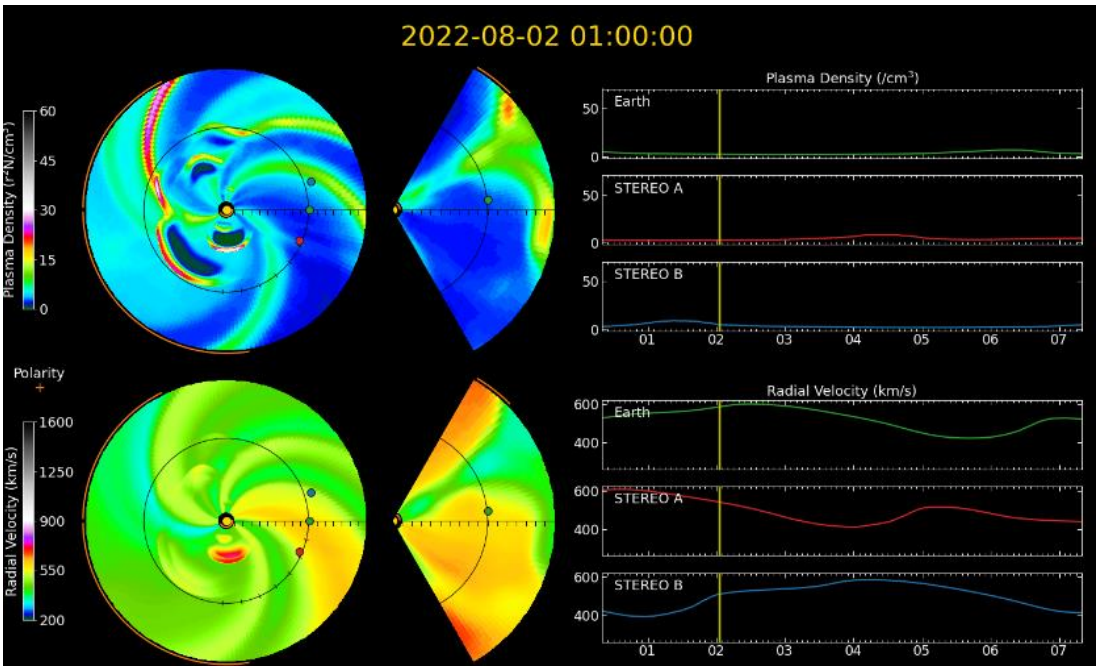
No Earth directed CMEs are currently expected.

Earth is currently embedded within the fast wind of CH07/- giving slightly elevated solar winds. This is a large northward extension of the southern polar crown, spanning nearly 50 degrees of longitude along the southern hemisphere. Solar winds are expected to remain elevated or slightly elevated whilst within this high speed stream (HSS), which is currently expected to persist through to day 3 (4th). The next fast wind arrival is expected on day 5 (6th) from CH09/+.

Geomagnetic activity should remain mainly Quiet with a chance of Unsettled or Active intervals through the period.

Geo-Magnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	No	5	5	5	1
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Figure 2: Enlil showing expected fast wind persistence until the 4th.



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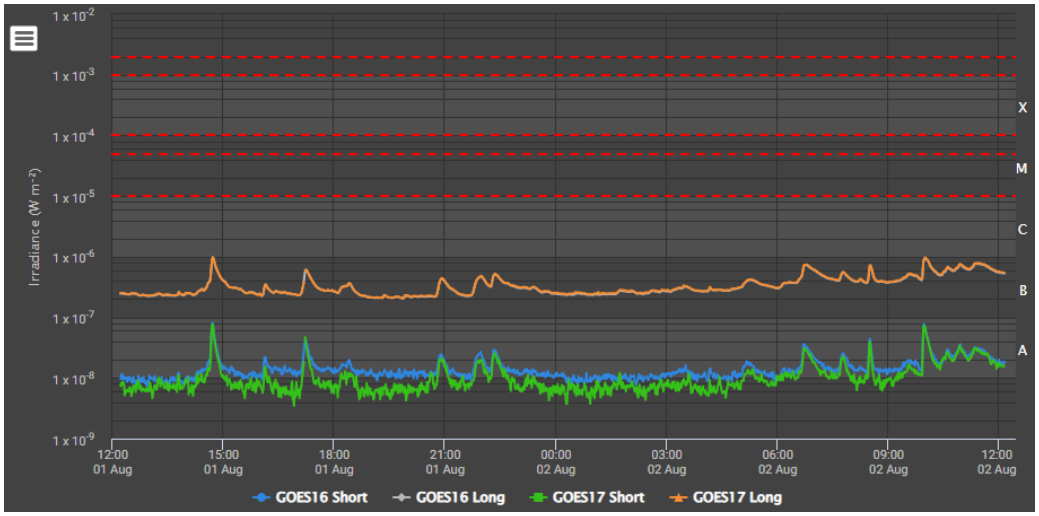
Radio Blackouts - X-Ray Flares:

Solar Activity is currently Very Low, with only two sunspot regions on the visible disc. The most prominent is in the central southern disc, AR3068 Esi/Beta-gamma. This has seen some growth just following its leader spot, with a reverse polarity region emerging and a subsequent increase in magnetic complexity. Despite this, it remains a relatively small region in terms of area, with only a slight chance of producing an M-flare. The other region is a small Hsx/alpha spot that has recently rotated over the southeast disc. This still has the potential to reveal further complexity as it moves into a clearer view, but current indications are that significant flaring from this region is unlikely.

Activity is likely to increase from Very Low to Low, with a slight chance of Moderate activity due to any M-flares that may occur, primarily from AR3068.

X Ray Flares Probability	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	R1-R2 M Class	No	20	20	20	20
Very Active	R3 to R5 X Class	No	1	1	1	1

Figure 3: GOES-16/17 X-ray Flux



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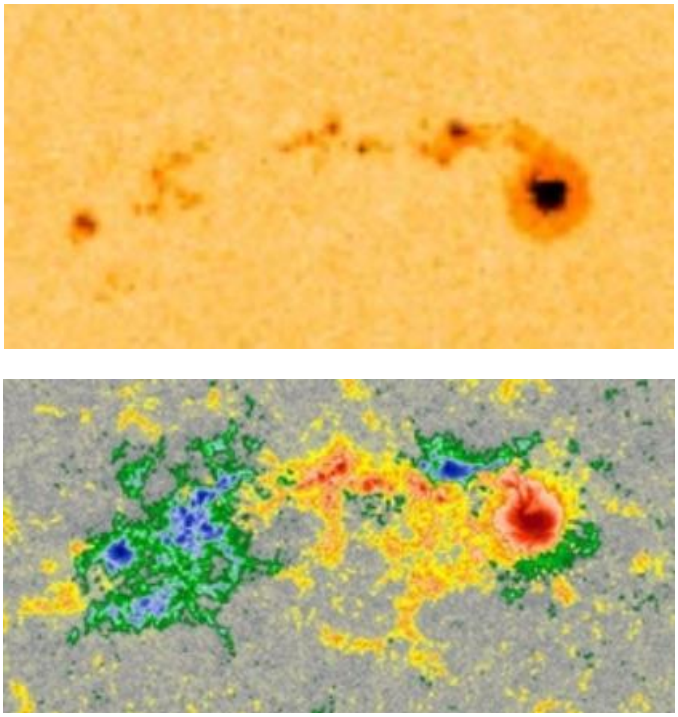
Solar Radiation Storms - (High Energy Protons):

The high energy proton flux (greater than 10 MeV) is currently at Background levels and is currently expected to remain at this level through the period. AR3068 will need monitoring for any further development, however, with the potential to increase radiation storm risks as it transits across the eastern solar disc.

Radiation Storms Probability (Exceedance)	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ S1**	No	1	1	1	1
Very Active	**≥ S3 ***	No	1	1	1	1
* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)						

Figure 4: SDO hmi-intensitygram and magnetogram of AR3068 Esi/Beta-gamma



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High Energy Electrons Event (≥ 2MeV):

The high energy electron flux (greater than 2 MeV) as measured by GOES-16 is initially expected to remain mostly at background levels, but a chance of rising to Moderate and approaching High (1000 pfu) at diurnal peak. This will most likely occur as solar winds ease later in the period allowing any recent enhanced electron population in the Van Allen Belt to relax back to GEO.

The associated 24 hour fluence, however, is expected to remain below the Active threshold (1e8 integrated pfu) throughout. While an increasing trend is likely, electron flux levels are currently not expected to persist at High for a sufficiently long period of time to result in fluence reaching Active levels. This is supported by REFM which is currently giving good guidance.

GEO Electron Environment Probability (Exceedance)	Level (cm^{-2} sr^{-1} day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ 2 MeV ≥ $1x10^8$**	No	1	1	10	10
Very Active	**≥ 2 MeV ≥ $1x10^9$**	No	1	1	1	1

Figure 5: GOES-16 >2MeV electron flux (top) and fluence with REFM (bottom)

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